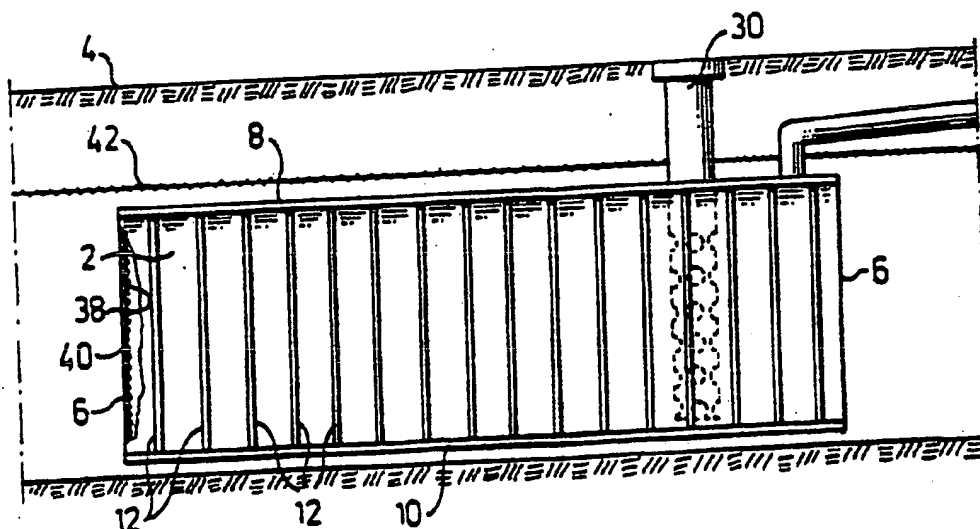




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>4</sup> :  E03F 5/10	A1	(11) International Publication Number: WO 89/09857 (43) International Publication Date: 19 October 1989 (19.10.89)
<p>(21) International Application Number: PCT/EP89/00359</p> <p>(22) International Filing Date: 3 April 1989 (03.04.89)</p> <p>(30) Priority data: 8801251-3 5 April 1988 (05.04.88) SE 8802202-5 13 June 1988 (13.06.88) SE</p> <p>(71) Applicant: WAVIN B.V. [NL/NL]; P.O. Box 110, NL-7700 AC Dedemsvaart (NL).</p> <p>(72) Inventor: SKOTTE, Klaus ; Frank Jaegers Vej 23, DK-8600 Silkeborg (DK).</p> <p>(74) Agents: DELHAGE, Einar et al.; Bergenstråhle &amp; Lindvall AB, Sankt Paulsgatan 1, S-116 47 Stockholm (SE).</p> <p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK, FI, FR (European patent), GB, GB (European patent), IT (European patent), LU (European patent),</p>	<p>NL (European patent), NO, SE (European patent).</p> <p><b>Published</b> With international search report. With amended claims and statement.</p>	

(54) Title: RAINWATER STORAGE



## (57) Abstract

A rainwater storage including a storage volume (2) located under ground level (4) and being defined by side (6), top and bottom walls, and containing load taking support elements (12) between top and bottom panels. The support elements (12) comprise outwardly essentially open profiles.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland				

Rainwater storage.

The present invention relates to a rainwater storage including a storage volume located under ground level and being defined by side, top and bottom walls, and containing load taking support elements between top and bottom panels.

5        A storage of this kind can be used as either a compensation basin for large surface water volumes, which cannot momentarily be taken up by a discharge system, or as a means for infiltration into the soil of rain water, collected on e.g. paved impermeable surfaces such as roads, parking lots, roofs or other built-up areas, as a way to prevent  
10       or at least decrease unwanted lowering of ground water level.

A rainwater storage of the kind defined above has the great advantage in comparison with a conventional rockfilled percolation storage, having a pore volume of approximately 40 %, that it needs 2.5 times less volume in the ground for storing the same volume of water.

15       A general object of the present invention is to improve a rainwater storage of the kind defined by way of introduction. A first specific object of the invention is to make possible efficient rinsing of the storage by simple means. A further object of the invention is to provide means simplifying the construction and setting-up of the  
20       storage. Still a further object of the invention is to provide means allowing location of the storage on a relatively high level with respect to ground level so as to eliminate the work and costs needed for locating the storage on a low level just out of surface load considerations.

25       According to a main aspect of the invention a rainwater storage of the kind defined above by way of introduction is characterized in that said supports are outwardly essentially open profiles.

30       Embodiments of the invention are defined in the subclaims, which more in detail prescribe measures and means for attaining one or more of the above-mentioned objects.

The invention and its various aspects will now be described more closely below with reference to embodiments shown on the drawings.

Figures 1 and 2 very schematically illustrate a rainwater storage according to the invention in sideview and planview, respectively,

Figure 3 is a longitudinal section of the storage according to Figures 1 and 2 illustrating more in detail some different components thereof, but leaving out some of the components shown in Figures 1 and 2 for the sake of clarity.

Figures 4 and 5 in transverse section illustrate two different embodiments of support profile elements to be used in the storage according to the invention,

Figure 6 in section illustrates part of a top or bottom panel for the storage according to the invention,

Figure 7 in section illustrates the attachment of the end of a profile element according to Figure 5 to a panel according to Figure 6,

Figure 8 in side view illustrates an attaching member to be used for obtaining the attachment according to Figure 6,

Figures 9 and 10 in plan view and side view, respectively, illustrate a quick coupling connecting element for connecting together four of the panels according to Figure 6 in a corner to corner relationship,

Figure 11 illustrates the use of the quick coupling connecting element according to Figures 9 and 10 for obtaining said connecting together of four panels in a corner to corner relationship.

The rainwater storage illustrated in Figures 1 - 3 includes a storage volume 2 located under ground level 4. The storage volume 2 as shown is defined by four sidewalls 6, a top wall 8 and a bottom wall 10. Between the top and bottom walls 8 and 10, respectively, support elements 12 in the form of outwardly essentially open profile pillars are located.

The profile elements 12 are preferably made of plastics and I- or X-shaped in section, as shown in Figures 4 and 5, respectively, and are therefore easily manufacturable, e.g. by extrusion, or pultrusion. Other shapes of the profile elements are also possible.

The top and bottom walls 8 and 10, respectively, are double walled panel-elements. These panels can e.g. be made in the form of

By means of load distributing elements 18 of a quick coupling type, as shown in Figure 8, the ends of the support profiles 12 are attached to the top and bottom panels. Each attachment element 18 includes a support plate 20 intended for abutment against the surface of the top or bottom panel designated 22. The support plate on the face thereof to be located remote from the panel 22 carries a protrusion 23 defining two mutually perpendicularly crossing slit shaped recesses 24, of which only one is visible in Figure 8. These recesses are adapted to receive, in this embodiment, the profile of the support element according to Figure 5, as indicated in Figure 7. It should, however, be noted that the attachment element could as well, in a similar way, be adapted to receive the profile of Figure 4 or any other profile. The side of the support plate 20 facing the panel 22 carries integrally therewith a pin 25. The pin 25 is intended to be received in corresponding holes in the walls 14 of the panel 22 so as to protrude slightly on the other side of the panel, as indicated in Figure 7. As further indicated in Figures 7 and 8 the pin 25 and the corresponding holes in the panel 22 may have engaging thread means or other friction increasing means.

The attachment element 18 due to its shape advantageously distributes the forces acting between the end of the support element 12 and the panel 22 so that no deforming action is exerted on the thin walls 14 of the light weight panel 22 by the ends of the support elements 12. The attachment element 18 also functions to take up vibrations and other dynamic loads.

The top and bottom walls 8 and 10, respectively, each comprise a number of top and bottom panels 22 of modular shape such as described above. Between each set of top and bottom panels 22 several support profiles 12 extend. The panels 22 of each of the top and bottom walls are mutually interconnectable from the outside of the storage, preferably by means of connecting elements 26 of a quick coupling type as disclosed in Figures 9 - 11. More particularly, these elements may be cross-shaped as shown in Figures 9 and 11 and have a transversely extending pin 27 at each of the ends of the crossing arms. The pins 27 are each intended to be received in a corresponding hole at the corner

of each a panel 22 as indicated in Figure 11, so as to connect together four panels 22 in a corner to corner relationship. As indicated in Figure 10 the pin 27 may have friction increasing thread means.

Returning to Figures 1 - 3, the storage according to the invention may include breathing pipes 28 and manholes 30. According to advantageous aspect of the invention a number of breathing pipes 28, one at each corner of the storage in the embodiment shown, are interconnectable to a common water supply as schematically indicated at 32 in Figure 2 for introduction of rinsing water into the storage, and the manholes 30 are then used for extracting the rinsing water by a suitable pump means, not shown, introduced therein. This arrangement makes possible a very efficient rinsing of the storage volume provided the breathing pipes and manholes take advantageous mutual positions. Preferably, as shown, the breathing holes can be located at the corners of the storage and one or more manholes more centrally thereof. It is also possible to attach other means for introducing the rinsing water into the storage, such as by pressurised water supply separate from the breathing pipes.

The outwardly open profile of the support elements 12 forms a very essential part of the whole rinsing concept since dirt can easily be removed therefrom during a rinsing operation.

The sidewalls 6 of the storage are formed by an inner load taking net 38 and an outer layer 40. Depending upon the requirements this outer layer may be an permeable soil textile or an impermeable plastic membrane.

Advantageously a load taking net 42 is essentially horizontally arranged in the ground layer immediately above the storage and extends at all sides a considerable distance beyond the circumference of the storage for proper distribution of loads applied to the ground surface above the storage. By this measure it is possible to locate the whole storage on a high level with respect to the ground surface also at sites where the latter may receive heavy loads, without risking break down of the storage.

Claims.

1. Rainwater storage including a storage volume (2) located under ground level (4) and being defined by side (6), top (8) and bottom (10) walls, and containing load taking support elements (12) between top and bottom panels, characterized in that the support elements (12) comprise outwardly essentially open profiles.
2. Rainwater storage according to claim 1, characterized in that the profiles are I- or X-shaped.
3. Rainwater storage according to claim 1 or 2, characterized in that the profiles are made of plastics.
4. Rainwater storage according to any of claims 1 - 3, characterized in that the ends of the support profiles (12) are attached to the top and bottom panels, respectively, by means of load distributing attachment elements (18) of a quick coupling type.
5. Rainwater storage according to claim 4, characterized in that the attachment element (18) includes a support plate (20) intended for abutment against the surface of the top and/or bottom panel (22), said support plate on the face thereof remote from the panel having recesses (24) adapted to the profile of the support element (12) for receiving the corresponding end portion of the support element.
6. Rainwater storage according to any of claims 1-3, characterized in that a plurality of top and/or bottom panels (22) each receive a group of several support profiles attached thereto, and are mutually interconnectable from the outside by means of connecting elements (26) of a quick coupling type.
7. Rainwater storage according to any of the preceding claims, characterized by the presence of breathing pipes (28) and/or manholes (30).
8. Rainwater storage according to claim 7, characterized by means (28) for rinsing the storage by way of introducing rinsing water into the storage at one or several points and by extracting this water including loosened deposits at one or more points (30) spaced away from the points of introduction.

9. Rainwater storage according to claim 8, characterized by the use of the breathing pipes (28) for introduction of the rinsing water and the use of the manhole(s) (30) for extracting the rinsing water.

5 10. Rainwater storage according to any of the preceding claims, characterized in that the side walls (6) thereof are formed by a load taking net (38) and a further layer (40).

11. Rainwater storage according to claim 10, characterized in that the further layer (40) is a permeable soil textile or an impermeable plastic membrane.

10 12. Rainwater storage according to any of the preceding claims, characterized in that a load taking net (42) is essentially horizontally arranged in the ground layer immediately above the storage and extends at all sides a considerable distance beyond the circumference of the storage for proper distribution of loads applied to the ground surface  
15 above the storage.



## AMENDED CLAIMS

[received by the International Bureau  
13 September 1989 (13.09.89);

original claims 1-3 and 10 replaced by new claim 1;  
claims 4-9, 11 and 12 unchanged but renumbered as claims 2-9 (2 pages)]

1. Rainwater storage including a storage volume (2) located under ground level (4) and being defined by side (6), top (8) and bottom (10) walls, and between top and bottom panels containing load taking outwardly essentially open profiled support elements (12), characterized in that the support elements (12) are made of plastics and that the side walls (6) are formed by a load taking net (38) and a further layer (40).
2. Rainwater storage according to claim 1, characterized in that the ends of the support profiles (12) are attached to the top and bottom panels, respectively, by means of load distributing attachment elements (18) of a quick coupling type.
3. Rainwater storage according to claim 2, characterized in that the attachment element (18) includes a support plate (20) intended for abutment against the surface of the top and/or bottom panel (22), said support plate on the face thereof remote from the panel having recesses (24) adapted to the profile of the support element (12) for receiving the corresponding end portion of the support element.
4. Rainwater storage according to claim 1, characterized in that a plurality of top and/or bottom panels (22) each receive a group of several support profiles attached thereto, and are mutually interconnectable from the outside by means of connecting elements (26) of a quick coupling type.
5. Rainwater storage according to any of the preceding claims, characterized by the presence of breathing pipes (28) and/or manholes (30).
6. Rainwater storage according to claim 5, characterized by means (28) for rinsing the storage by way of introducing rinsing water into the storage at one or several points and by extracting this water including loosened deposits at one or more points (30) spaced away from the points of introduction.

7. Rainwater storage according to claim 6, characterized by the use of the breathing pipes (28) for introduction of the rinsing water and the use of the manhole(s) (30) for extracting the rinsing water.

5 8. Rainwater storage according to any of the preceding claims, characterized in that the further layer (40) is a permeable soil textile or an impermeable plastic membrane.

10 9. Rainwater storage according to any of the preceding claims, characterized in that a load taking net (42) is essentially horizontally arranged in the ground layer immediately above the storage and extends at all sides a considerable distance beyond the circumference of the storage for proper distribution of loads applied to the ground surface above the storage.

Fig. 1

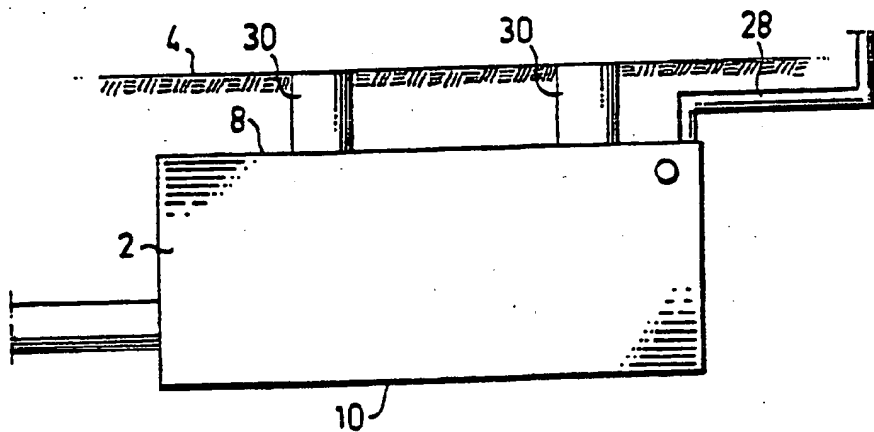


Fig. 2

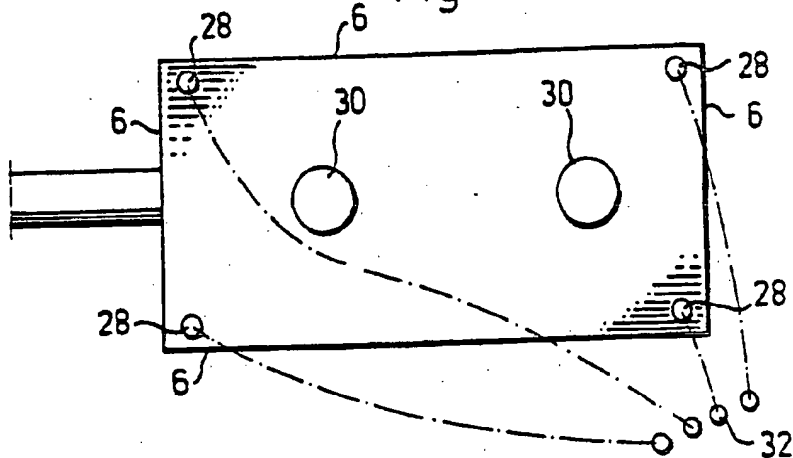
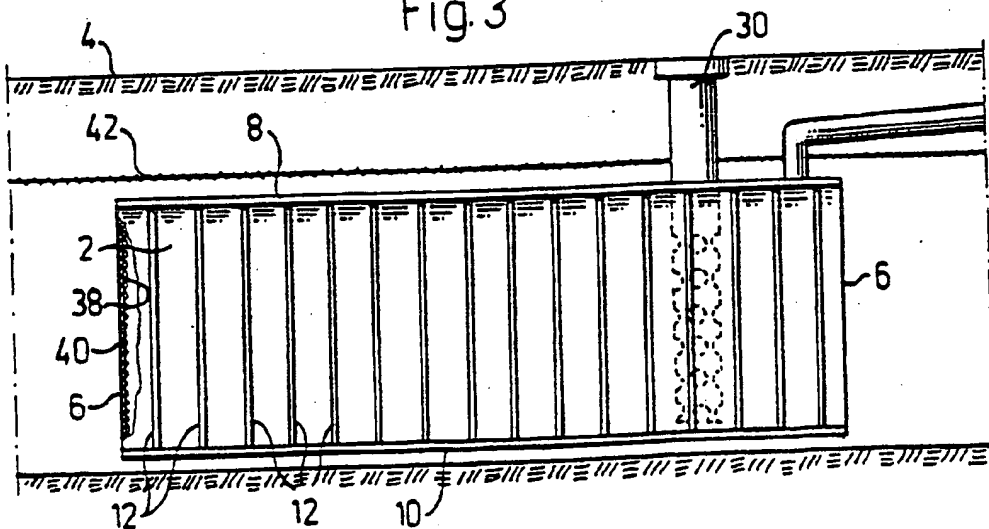


Fig. 3



**SUBSTITUTE SHEET**

Fig. 4

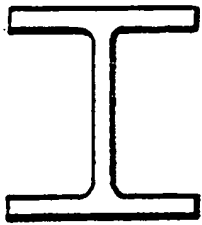


Fig. 5

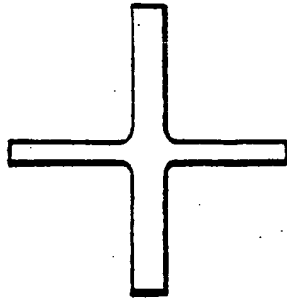


Fig. 6

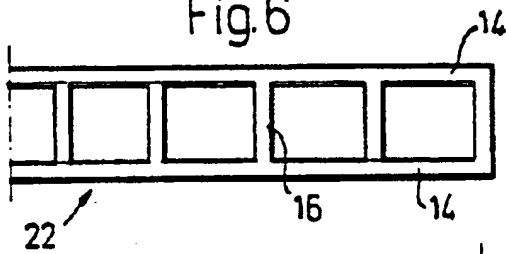


Fig. 7

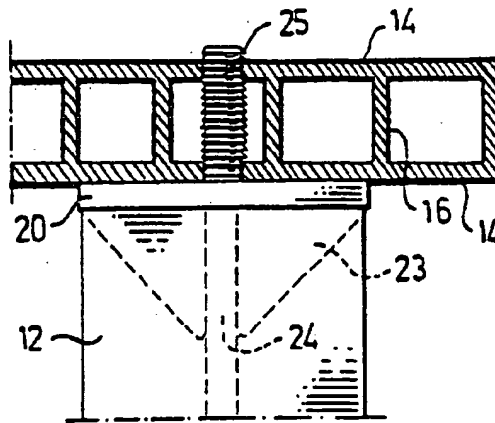


Fig. 8

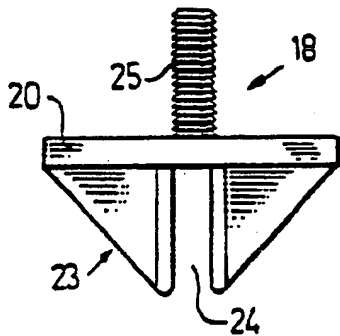


Fig. 9

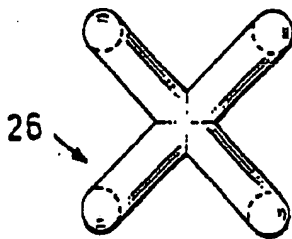


Fig. 10

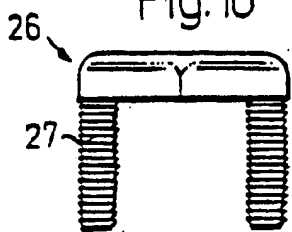
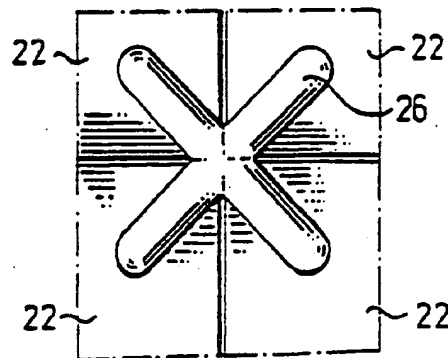


Fig. 11



# INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 89/00359

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC IPC <sup>4</sup> : E 03 F 5/10		
<b>II. FIELDS SEARCHED</b> <div style="display: flex; justify-content: space-between;"> <span>Minimum Documentation Searched *</span> <span>Classification Symbols</span> </div> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">IPC<sup>4</sup></div> <div>E 03 F; E 03 B; E 04 H; B 65 D</div> </div> <div style="margin-top: 10px; font-size: small;">         Documentation Searched other than Minimum Documentation          to the Extent that such Documents are Included in the Fields Searched *       </div>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b>		
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **
Y	EP, A, 0115762 (STADT NEU-ULM) 15 August 1984 see page 2, lines 20-24; figures 1,2	1,2,3
A	--	4,8
Y	GB, A, 506782 (J.H. LAITHWAITE & W. NEILL & SON) 29 June 1939 see page 2, lines 102-110; page 3, lines 77-96; figures 1,6	1,2,3
Y	EP, A, 0159382 (TOSCHI PRODUKTIONS-GmbH) 30 October 1985 see page 8, line 26 - page 9, line 16; page 13, line 32 - page 15, line 2; figures 1,3	3
A	--	4,5,10,11,12
A	DE, A, 3308156 (TOSCHI PRODUKTIONS-GmbH) 13 September 1984 see pages 8-10; figures 1,2,5	1,5,6,10,11
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%; font-size: x-small;">           * Special categories of cited documents: **            "A" document defining the general state of the art which is not considered to be of particular relevance            "E" earlier document but published on or after the international filing date            "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)            "O" document referring to an oral disclosure, use, exhibition or other means            "P" document published prior to the international filing date but later than the priority date claimed         </div> <div style="width: 50%; font-size: x-small;">           "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention            "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step            "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art            "Z" document member of the same patent family         </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search 29th May 1989	Date of Mailing of this International Search Report 17 JUL 1989	
International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer  P.C.G. VAN DER PUTTEN	

International Application No. PCT/EP 89/00359

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 4689145 (L.R. MATHEWS & J.A. WORK) 25 August 1987 see column 5, lines 19-41 --	7,8,9
A	DE, A, 2721568 (TOSCHI GmbH & CO. KG) 16 November 1978 -----	

# ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 8900359

SA 27693

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the European Patent Office EDP file as of 12/06/89  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0115762	15-08-84	DE-A, C 3300130	12-07-84
GB-A- 506782		None	
EP-A- 0159382	30-10-85	None	
DE-A- 3308156	13-09-84	None	
US-A- 4689145	25-08-87	None	
DE-A- 2721568	16-11-78	None	

EP 8900359

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

☐ BLACK BORDERS

☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES

☐ FADED TEXT OR DRAWING

☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING

☐ SKEWED/SLANTED IMAGES

☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS

☐ GRAY SCALE DOCUMENTS

☒ LINES OR MARKS ON ORIGINAL DOCUMENT

☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY

☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**